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# COLLECTIVE FARMING IN RUSSIA AND THE UKRAINE[1]

By Sir JOHN RUSSELL, F.R.S.

DIRECTOR OF ROTHAMSTED EXPERIMENTAL STATION

AT the outset I must remind you of a few geographical facts in regard to European Russia. It is a vast rolling plain, with no mountains except at its edges, but it has a backbone of higher land in the center so that most of the rivers rise here and wind slowly north, south or east to the sea. Moscow at the center owes its rise and development to the fact that it is near to all of them. The rainfall (including the snow) is highest in the west central part and falls off as you go to the southeast, but it is nowhere high by English standards: not more than 25 inches. In the wetter part there is much forest; coniferous trees and birch in the north, more deciduous trees in the center and to the south, but with much marsh. To the southeast, where the rain suffices for grass but not for trees, there is the black earth and the steppe, and still further eastwards the steppe becomes more arid in character. The forest and the steppe have given a distinctive character to Russian life, just as its rivers have played a great part in shaping its history. It is impossible to convey any adequate impression of the vast size and almost endless solitude of Russia: even in 1935 only about 6 per cent. of the land of European and Asiatic Russia was in cultivation; the rest was mostly wild.

From early times the Russians adopted a system of agriculture very much like the old three-field system, with its scattered strips common in northern Europe. Alongside a feudal system very different from ours were the peasant Communes who held in common the land alloted to them, periodically redividing it among themselves. The peasants' share grew steadily, and

[1] Afternoon lecture, Royal Institution of Great Britain, December 18, 1941.

they always wanted the whole of it; they had an unchangeable belief that the land belonged to the men who tilled it. There is an old peasant saying: "My back belongs to my master but the land belongs to me"—and this in spite of another: "The peasant's back is made to be beaten."

The agricultural system had two grave defects: it was incapable of technical improvement and the scattered strips involved much waste of time. Stolypin in 1910 had arranged for consolidation of the holdings and for the establishment of peasant farms with state loans to finance improvements, the logical outcome would have been the Danish cooperative system. But before his reforms could achieve results the war came on and then the Revolution. The peasants joined in the liquidation of the landlords, believing that at last the whole of the land would be theirs. They were bitterly disappointed when they found it was not.

One of the earliest of the new activities was the establishment of state farms. They were on factory lines. The farms were very large, so as to secure all the advantages of large-scale management and allow of the fullest use of machinery and of scientific methods; one of the best known was Gigant on the Don Cossack steppe about 120 miles due eastwards from Rostov. When I first visited it in 1930 it exceeded half a million acres—considerably larger than Leicestershire—and, as usual in those days, the director was a politician, the justification being that the purpose of all the national activity was the founding of a new order of society, and the detailed work of running a farm was only incidental thereto. He had, however, a technical adviser, but the director need not accept his advice. I still remember the long and impassioned speech on the principles of Marxism and Communism to which I had to listen on a hot day in August, with the camera men and their dazzling searchlights actively at work the whole time. The area proved too big. Another one I visited was half the size—but still nearly as large as Bedfordshire. The workers, instead of living in separate cottages, were housed in great barracks; they had their separate bedrooms, but a common dining room; there was also a large meeting room—a sort of theater. As everywhere in Russia there were political slogans in huge letters on scarlet banners hung up on the walls, with portraits of Lenin, Marx and Engels. On my second visit in 1934 the slogans were a little different: "Practice self criticism; do not judge by looking at other people's faces"; "Develop Party Politics" and the portraits had changed, more prominence being given to Stalin.

But the peasants never really liked these state farms and they were not developed. There was for a time a period of what was almost peasant proprietorship, which the peasants liked much better. It was the so-called "New Economic Policy," dominated by Bukharin's slogan of 1925, "Peasants, get yourselves rich!" But it was theoretically objectionable, so was given up. It was replaced by a new method, Collectivization, introduced in 1927 and actively developed from the spring of 1929; the method is attributed to a Ukrainian. The entire village and all its agricultural land was to be run as one farm. All land divisions were to be obliterated and the whole area, which might be 2,000 acres or more—in the south and the Volga regions it might be up to 10,000 acres—was divided into some half-dozen fields, to correspond with the rotation; the whole village population were to come in as workers. No wages were to be paid but all their possessions were to be pooled and all the produce shared after the necessary outgoings, including the Government share, had been met.

There was at first tremendous opposition on the part of the peasants. They understood the idea of collective ownership of land but not of livestock. Those who had worked hard and built up a little farm, with a few animals and implements and stocks of seeds, greatly resented having it all taken away. Further, the poor harvests of 1931 and 1932 and the many requisitions of grain, left them faced with hunger and rather than give up their animals they killed and ate them, doing much other destruction; in short, they adopted the "scorched earth" policy, the Russian peasants' traditional method of dealing with a hostile situation. The government took a strong line and great numbers of peasants were removed and disappeared: how many will never be known; in the unequal struggle they lost as they were bound to lose. But Russia came near to starvation, and in the end Stalin called off the fight. The fall in numbers of livestock was enormous.

Several methods were adopted in trying to reconcile the peasants to the new order. Probably the most effective was the introduction of the tractor. The peasants were shown what it could do; how it could plough in one day far more than any of them could have done in a week, and so the tractor was sent round adorned with a banner and accompanied by a shock brigade practising all the arts of propaganda in which the Russians are such past masters, and compulsion as well. The tractor became much more than an implement; it became the symbol of advancing civilization—"overcoming the age-old backwardness and poverty of agriculture" to quote one of the slogans. The Russians, even the peasants, have an innate respect for what they call "culture": the connotation is much wider than in English and it includes all the amenities and decencies of civilized life. You not infrequently find notices telling you to use a particular appliance "in a cultural way"; you can not insult a Russian more deeply than to say that his actions are "uncultural." The propagandists were very zealous Communists fired

with missionary zeal and what seemed to an Englishman almost fantastic enthusiasm. You will find the full story in Sir Bernard Pares' remarkable little book on Russia, and dramatic accounts in Maurice Hindu's "Red Bread" and in Sholokov's "Quiet Flows the Don" and "Virgin Soil Upturned." I knew several of the propagandists: one, a White Russian peasant, who felt she owed everything to the Revolution, was almost the living image of the chief character in Sholokov's story.

What, however, most sharply distinguished the new system was that production was planned: the first five-year plan ran from 1928 to 1933; they were in the third when war broke out. Individual farms were not left to grow what they liked, they were told what they must grow and how much of it they were expected to produce. The plan is drawn up at the State Planning Committee (Gosplan) in Moscow, it allocates the respective shares to the different regions and notifies the governments of those regions. These can make suggestions for changes which are duly considered, but the final decision lies with Moscow. The regional government allocates the plan to the different districts and these to the different farms. Here again discussion is permitted, but once the final decision is made it must be accepted. So each collective farm knows what it has to do.

The plan for 1937 and for 1941 in comparison with the realization of 1938 are given in Table I.

TABLE I

AREAS PLANNED FOR SOWING IN 1937 AND 1941 AND ACTUALLY SOWN IN 1938

| Million ha. 1 ha. = 2.47 acres | Plan for 1937 | Realized in 1938 | Plan for 1941[2] |
|---|---|---|---|
| Total area sown ... | 138.9 | 136.9 | 157.0 |
| Grain ..... | 104.0 | 102.4 | 111.0 |
| Vegetables and Fruit | | 9.4 | 11.4 |
| Fodder crops ..... | 13.7 | 14.1 | 22.5 |
| Technical crops .... | 11.0 | 11.0 | 12.0 |

Total area of U.S.S.R. 2109 million ha.

[2] N. Voznesensky. Economic Results of the U.S.S.R.—1940 and Plan—for 1941, Moscow 1941. It is not clear whether the boundaries are the same as in 1938.

The 1939 plan (Table II) shows the relation of collective to state farms and gives the proportion of fallow. The figures are in million hectares.

TABLE II

| | Collective Farms | State Farms | Total |
|---|---|---|---|
| Spring crops .. | 76.14 | 7.51 | 83.65 |
| Winter crops .. | 34.30 | 2.28 | 36.58 |
| Fallow ..... | 29.63 | 3.18 | 32.81 |
| | 140.07 | 12.97 | 153.04 |

Great efforts are made to utilize science as fully as possible. Even before the Revolution Russia had possessed good agricultural colleges and agricultural research stations where important investigations on soil formation and soil classification had been carried out. After the Revolution these were greatly expanded and new ones were added.

Elaborate soil surveys were organized under Polynov at the Dokuchaiev Institute, which was founded at Leningrad but transferred in 1933 to Moscow, and soil maps were prepared for use in drawing up the plan for agricultural production. Investigations on the manuring of crops were made by Prianishnikov and his staff at the Timirazev Academy, and successful search was made for natural deposits of potash and of phosphate; nitrogenous fertilizers were made synthetically. Rotations were studied by Williams—son of an American engineer and a Russian mother—whose knowledge of English agriculture convinced him that grass and clover and cultivated crops must be included as they had been in England. He worked out basic rotations which have been adopted and modified in the different regions; it has been necessary to keep the fallow in most regions, but occasionally it could be replaced by crops where the rainfall is higher. The old three-course rotation was thus changed as shown in Table III.

TABLE III

OLD AND NEW ROTATIONS IN U.S.S.R.

| | | Modern 6 or 8 courses | | | |
|---|---|---|---|---|---|
| Old 3 courses | Williams' proposal[3] | Dry Regions (Saratov) | Moister Regions (Gorky) | (Ukraine) | Old Norfolk |
| Fallow | Fallow | Fallow | Fallow | Grass | Clover |
| Winter rye or wheat | Winter wheat | Winter wheat | Winter wheat | Winter wheat | Wheat |
| | 2 years Lucerne and grass | 3 years Lucerne | | | Cultivated crops |
| Spring corn | Spring wheat (hard) | Spring wheat | Spring corn | Spring corn | Spring corn |
| | Spring wheat (soft) | | | | |
| | Sunflowers etc. | Sunflowers | 2 years grass | Cultivated crops | |
| | Wheat | | Flax | Millet | |
| | Millet etc. | | Cultivated crops | | |
| | | | Spring corn | | |
| | | Percentage of | | | |
| fallow 33 | 11 | 14 | 12.5 | | |
| grain 66 | 44 | 28 | 37.5 | 40 | 50 |

[3] Separate fodder crops are grown for the animals.

These rotations are not yet widely adopted; if they were the percentage of fallow would have been reduced to about 14; as it is, it is 20 to 25, which, of course, is a great improvement on the 33 per cent. of the old three-course rotation.

In addition to the central institutes, there are large institutes with research staffs studying the most im-

portant problems of the different regions. One of the best known of these is (or was) at Odessa, where Lysenko did much of his work on vernalization and on the production of new varieties of wheat and cotton, not on Mendelian but on Marxist lines. He comes of a peasant family and was greatly honored as the embodiment of the Revolution—the peasant become Academician.

The Saratov Institute is another example. It was started in 1929 and has expanded so that in 1939 it had a staff of 118 senior scientific and technical workers and 280 assistants, with a budget of 3 million rubles per annum; still further extensions were contemplated. Its principal work is the struggle against drought and the staff are daily reminded of this by a huge scarlet banner hanging up in the conference room and bearing Molotoff's slogan, "The Bolshevik struggle against drought is the organized struggle on Soviet lines for the harvest." The average rainfall of the region is only 12 inches per annum, and often there is less or it is badly distributed and then comes famine. Drying winds, dust and mist also do much damage. The chief crops are wheat and sunflower; the latter gives an oil much used in cooking; it makes good to some extent deficiencies of other fats. Suitable resistant varieties of both crops have been obtained by cross-breeding (in-breeding has been given up). Great efforts are being made to find out how to grow potatoes in these naturally unsuitable conditions. The potato crop is being extended wherever possible, its dietetic value being fully recognized.

Associated with these institutes are advisers who tour the countryside and keep in touch with the collective farms. These advisers have a local center, called a "hut" laboratory, usually a cottage fitted up as a museum or showroom, with pictures of common diseases and pests, specimens of fertilizers, improved varieties of seeds and other things about which the adviser would talk and, generally speaking, anything likely to interest or help the peasants.

The organization within the farm is comparatively simple. The members of the collective meet and elect a committee and a chairman, who, however, must be acceptable to the Party; he receives a higher rate of pay than the others. The ordinary members of the committee are not paid, however, but regard their service as a social duty. The committee decide how the plan is to be carried out, they can not modify it but only discuss how best to do it. They divide the workers into groups called "brigades" (military terms were used from the outset), each under a leader and they allocate the tasks. The numbers of workers per 100 acres are usually much higher than those to which we are accustomed.

There is also another official whose role is less easy to describe: the representative of the Party. When collectivization began Stalin had declared that the Party "can no longer confine itself to individual acts of intervention in the process of agricultural development; it must take over the leadership of the collective farms." Those I have met were not technical men; they have to see that the plan and also the decisions of the Party are carried out. In 1934 their influence was very great, but in 1937 and especially in 1939, I got the impression that it was less; also the function had changed;[4] the office had, of course, the usual photographs—Stalin, Molotov, Kalinin—but there were also exhibits of technical interest. Very few of the members of the collective are members of the Party, the idea is to keep it small and select so as to ensure obedience and efficiency. This is true all over Russia; by far the greater part of the population call themselves "sympathizers," and many of my Russian friends have assured me, especially in the years before 1937, that this was the safest line to adopt. A member of the Party might do well for a time, but if he got "purged" it was bad for him. The young people are advised to become Pioneers (aged 10 to 16) and afterwards Komsomolisy (ages 16 to 21) but only few will become Party members.

Rules and regulations are fairly numerous, and are posted in a prominent place for all to see. An outlet for the farmer's universally admitted right to grumble is found in the so-called "Wall Newspaper," a sheet written by hand and hung up prominently, where complaints may be voiced and offenders against the rules may be reproved. Thus you may read that Ivan Feodorovitch drinks too much and so doesn't get his day's work properly done; that Boris Dimitrievitch is an idle fellow and must mend his ways. In 1930 the wall newspapers had been very serious and I have known a professor put in considerable trepidation because a student had written saying that his lectures were dull and no one could learn anything from them. But as time went on the comic sketch and the humorous article began to appear.

Every effort is made to increase output. As between different farms and regions "Socialistic competitions" were started. In his speech at the 1934 Plenum of the Communist Party of the Ukraine, Postyschev declared that "we have aroused a tremendous war of socialist competition between regions and districts, collective farms and brigades. We discovered thousands of heroes of collective farm production." And in the wonderful agricultural exhibition in Moscow opened in 1939 there hangs, written in scarlet, Molotov's dedication: "This exhibition shows the whole program for agricultural improvement and should stimulate competition between farms and Machine Tractor Stations,

[4] See L. H. Hubbard, "Economics of Soviet Agriculture," pp. 157 and 319, for a full account.

between districts and regions and republics." A banner is given to the winner of a competition.

Other methods are applied to stimulate individuals to greater activity. Besides the admonitions of shirkers in the wall newspaper, direct encouragement is given to the best workers by publicly exhibiting their photographs. In the earlier days these best workers were organized in special brigades, the "shock brigades"—the udarniki—which were called in when work was specially important or urgent. They had certain special privileges. In recent years these specially effective workers are called Stakhanovites after a coal miner Stakhanov, who found a way of considerably increasing his output. As they are paid on a piece-work basis the more they do the more they earn. In 1939 the method was being intensified and a farm that exceeded its "planned" output was to receive a bonus on all excess deliveries, so that workers and especially its Stakhanovites would receive still higher rates of pay. In consequence one meets with great inequalities of income in Russia.

The payment on the farm is mostly in kind. Various outgoings have to be met. The government share has to be sent off; there is a very small payment for it. The machine tractor station has to be paid for its services, and provision has to be made for seed, insurance, capital expenditure and such social services as sick and needy, the crèche, etc. Whatever is left is shared among the workers in accordance with the number of "labor-days" they have put in: the classical formula "to each according to his needs" was found unworkable and was replaced by "to each according to his work" now embodied in Article XII of the Constitution. A "labor-day" is not counted by time but by the job. The committee decides that a certain job, such as the sowing of a certain area of land or the milking of a certain number of cows, is a day's work, and when this is done the worker gets credit for one "labor-day." He can accomplish two or even three "labor-days" in one day; then he gets double or treble pay. The calculation of the remuneration is very complex; it is made with an abacus, a little instrument possible only because everything is done on the decimal system: yields are in quintals per hectare and prices in kopeks and rubles (1 r. = 100 kopeks). Some of the figures are given in Table IV.

The system involves the peasant bearing the loss due to season or diseases, and in consequence even on the same farm the payment varies from year to year. In any given year the peasant never knows what he will receive until the harvest is in and the accounts all paid. Naturally during the year he has to draw advances.

It is not possible to say how much of the total produce is available for division among the peasants. Figures given me on a number of farms vary: some range about 50 per cent.[5], but this is still subject to loss on storage which may be considerable.

Troubles lasted for some time. I remember well in 1930 a disgruntled group of peasants who, having put the invariable question "Are you a worker?" and received a favorable reply, proceeded to show me a day's ration of bread, already mouldy and smelling badly, and then offered me some tobacco. I said I didn't smoke and they replied: "It is just as well, this tobacco would only make you sick." So also in 1934 there was much discontent. Then in 1937 I saw a marked change. The peasants had always wanted to own the land and this desire for ownership was recognized. By the new Constitution of 1936 the land and all that is beneath it was declared in Article 6 to be "state property, *i.e.*, the property of the whole people," but by Article 8 "The land occupied by collective farms is secured to them for perpetual use, *i.e.*, for ever." As I visited each farm in 1937 I was shown with great pride and with sparkling eyes the title deeds recently received, vesting the land in the collective forever. The peasants now believed that at last the land really was theirs. The long struggle, first with the landowners and then with the state, seemed to be terminated in their favor. Further, the peasant's desire for a piece of land of his own was granted. Article 7 stated that "Each collective farm household has for its own use a plot of land attached to the house and as

TABLE IV

VALUE IN MONEY AND KIND OF ONE "LABOR-DAY" IN CERTAIN COLLECTIVES IN DIFFERENT YEARS

| | | Shpitky, Ukraine | | | Karl Liebnecht Ukraine | Steingut | Saratov | Tarasocka Moscow |
|---|---|---|---|---|---|---|---|---|
| | | 1933 | 1935 | 1936 | 1936 | 1937 | 1938 | 1937 |
| Grain | kilos | 1 | 1.8 | 2 | 2.5 | 2 | None | None |
| Potatoes | " | 5 | 4 | 10 | 0.5 | ... | ... | 10 |
| Hay | " | 4 | 1 | 1.5 | 5 | not measured | | 3 |
| Vegetables | " | 3 | 1.5 | 2 | 3 | ... | ... | 10 |
| Apples | " | 0.1 | ... | .... | (Grapes 0.5 k | 3 | 1 | .. |
| Honey | " | ... | 0.1 | 0.2 | Wine 0.5 l.) | | (Cherries 0.2) | .. |
| Cash | r. | 0.79 | 0.70 | 1.10 | 10 | 4.70 | 5.03 | 20 |

[5] From "Collective Farms in the Second Five Year Plan," a statistical summary issued by Gosplan, it appears that in 1937 the average "Labor-day" rewards per "Dvon" (household) were 17.4 q. of grain and R. 376 in money. This works out at about 30 per cent. of the total grain harvest and about 48 per cent. of the total money income.

individual property—the house, produce animals and poultry." Later decrees regulated the size of the holdings: they vary from half up to one or more acres, according to the region and the type of farming; on these the peasants can grow what they like. Each household was promised a cow, one or two pigs and some poultry. The peasants may dispose of the produce to the cooperative or in any way they please; there is, in fact, a good deal of selling in peasant markets especially by the women. Many found their own piece of ground more profitable than the collective. The peasant's wife and children may help him, but he may not pay any wage; that would amount to exploitation of a man's labor, which is forbidden. You may hire a person to look after your house or your dog if you have one, but not to look after your cow because that is an animal for production.

Thus the peasant's total income is derived partly from the collective, partly from his own plot and sometimes from other labor. The proportions vary a good deal. In the Gosplan publication already quoted the average income from labor-day payments per household in the collective farms in 1938 was 17.4 q. of grain and R. 376, while the total income was R. 5,843; putting the grain at R. 25 per q., the income from the farm is less than 14 per cent. of the total. On the other hand, the percentage distribution of working hours in 1937 was[6] as given in Table V.

Whatever the average, some workers instead of putting in the average two hundred labor-days on the collective, were putting in far fewer, and stringent orders were issued that not less than 60 to 100 labor-days per annum (according to the district) must be devoted to the farm.

In one direction, however, the private property took on very large proportions. It has been already stated that the livestock were drastically reduced when collectivization began. The numbers fell till 1933, then slowly rose, but the increase has been marked since the peasants were allowed animals of their own. By 1936 the numbers of animals on the collective farms were, in millions,[7] as shown in Table VII.

TABLE V

| | Work on the collective | Work on private allotment | Work outside the farm | Domestic and other duties |
|---|---|---|---|---|
| Men ... | 67.5 | 4.0 | 23.9 | 4.6 |
| Women . | 52.8 | 19.6 | 7.1 | 20.5 |

TABLE VI*

| | Income: r. per worker per annum | | | Distribution of time | | |
|---|---|---|---|---|---|---|
| | from collective | from private allotment | Per cent. of income derived from collective | on collective | on private | other work |
| Superior farms | 5510 | 597 | 90 | 85 | 14 | 1.0 |
| Good farms .. | 4267 | 771 | 84.6 | 80 | 17.5 | 2.4 |
| Medium farms | 3035 | 849 | 78 | 72 | 22.6 | 5.4 |
| Poor farms .. | 2080 | 852 | 72 | | | |

* These figures show the impossibility of generalizing about collective farming. I am indebted to Mr. L. Hubbard for these and other data.

TABLE VII

| Ownership | Cattle | Pigs | Sheep and goats | Land under crops, million ha. |
|---|---|---|---|---|
| Collective ... | 14.8 | 6.3 | 22.75 | 116.0 |
| Private ..... | 25.2 | 12.9 | 31.26 | 9.1 |
| Private as per cent. of collective .... | 172 | 207 | 137 | 8 |

*(To be concluded)*

# INTERNATIONAL SCHOLARSHIPS AND FELLOWSHIPS[1]

By Dr. FRANK AYDELOTTE

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PERHAPS no great educational system has ever been so truly international as that of the United States. From Colonial days American students have gone abroad seeking education in every land under the sun, and from the time of their foundation American universities have welcomed, and indeed sought, students and professors from every country on earth. American education has never been isolationist.

At the end of the nineteenth century American students went in large numbers to the great German universities of that day and American scholarship owes much to German example. From Germany our students brought back the ideal of academic freedom which is rigorously maintained to this day in the

[6] As against this in "Communal economic foundations of Kolchoznik prosperity, 1941" it is stated that in the province of Voronezh the ratio of income from work on the collective farms and on private holdings was as given in Table VI.

[7] *Kolkhozy vo vtoroi Stalinskoi Piatiletke, 1940.* Beside these animals there are others on the state farms, but even when these are added in the privately owned animals are still 40 per cent. of cattle and pigs and 30 per cent. of sheep and goats.

[1] World-wide broadcast of the American Philosophical Society and WRUL, Philadelphia, June 19, 1942.

United States, although it has been abandoned in Nazi Germany.

In the field of international scholarships and fellowships during the last forty years, the United States has probably led the world in the number of foundations and the number of students concerned. The pioneer in this field, however, the man who established the first and the best known plan was not an American but an Englishman who lived his life in South Africa, Cecil John Rhodes. When Rhodes died in 1902 and his famous will was published there were, aside from the Boxer Indemnity Scholarships, only a few scattered opportunities for international study in existence. The Rhodes will was one of the most daringly imaginative documents in the history of education. By it were established approximately two hundred scholarships from the United States, from the British Dominions and from Germany for study at the University of Oxford. Nearly one half of these appointments went to the United States—two for each of the forty-eight states, or ninety-six in all.

During the period of nearly forty years since the first Rhodes Scholars were selected in 1904, over two thousand men from the various countries concerned have pursued their studies at Oxford and are now following their careers in the various lands of their origin. There are over one thousand ex-Rhodes Scholars living in the United States; they may be found in every corner of the country and in almost every occupation.

The contribution of the Rhodes Scholars to American life has been a notable one. It has perhaps been most significant in education, but it has been by no means limited to that field. The success and the prestige of the Rhodes Scholarships have been such as to exert a remarkable influence on American philanthropy, in the first place by bringing about the establishment of systems of fellowships reciprocating the Rhodes Scholarships, bringing English students to study in American universities; and in the second place by influencing the establishment of funds with a similar purpose, offering American students other opportunities for study abroad.

It is a noteworthy fact that since the Rhodes Scholarships were established opportunities have been created in the United States for bringing each year as many Englishmen—indeed, rather more—to study in American universities as there are American Rhodes Scholars going to Oxford. The Commonwealth Fellowships bring the largest number and most definitely reciprocate the Rhodes scheme. There are, in addition, the Davison Fellowships to Harvard, Yale and Princeton, the Choate Fellowship to the Harvard Law School, the Procter Fellowships at Princeton, the Riggs Fellowships at the University of Michigan and the Henry Fellowships to Harvard and Yale. The fact that generosity begets generosity has been notably illustrated by this reciprocation of the Rhodes plan.

The second general result of the Rhodes Scholarships is no less interesting—the establishment of American foundations with a similar purpose. The most important of these is the John Simon Guggenheim Memorial Foundation, offering research opportunities to older scholars, suggested to the founder in the first instance by the example of Rhodes and organized and administered by Rhodes Scholars.

The Guggenheim Foundation is intended for scholars who have already demonstrated unusual aptitude for independent research or for creative work in any one of the Fine Arts, including music. American fellows may study in any country where their work may best be done and they work under the freest possible conditions. In addition to appointments for American scholars to work in this country or abroad, the Guggenheim Foundation offers fellowships in a steadily increasing number of countries of the western hemisphere for scholars who wish to pursue their researches in the United States. These countries include at present Canada, Mexico, Cuba, Puerto Rico, Brazil, Uruguay, Argentina, Chile and Peru.

Other systems of international fellowships open to American students, all owing something to the Rhodes example, are the Henry Fellowships to Oxford and Cambridge; the fellowships established by the Commission for the Relief of Belgium, for study in Belgian universities; the American Field Service Fellowships to French universities; and the fellowships offered by the American-Scandinavian Foundation, by the American School of Classical Studies in Athens, the American Academy in Rome, the Institute of Current World Affairs, the Kosciuszko Foundation, the Lalor Foundation and the Oberlaender Trust.

Even more widely extended are the appointments, varying in number and plan from time to time, offered by the Rockefeller Foundation, bringing scholars from other countries to the United States, from the United States to various European countries, and from one European or South American country to another. The Carnegie Corporation has likewise, without establishing any single uniform scheme, supported a very large number of individuals whose plans made it necessary for them to go from one country to another.

The Institute of International Education, which administers the American Field Service Fellowships to France, supervises also a very large number of appointments open to foreign students who wish to study in the United States or to American students who wish to study in some foreign country. Many of these fellowships are supported by small funds; others are individual exchanges. There are some twenty-five or thirty countries involved in these ex-

changes and the total number of students going in one direction or the other has in recent years varied between 6,000 and 9,000.

It could not be said that all of these fellowships are directly connected with the Rhodes scheme, but it can hardly be doubted that most of them have been influenced directly or indirectly by the prestige of the Rhodes plan.

The purpose announced by Cecil Rhodes in establishing his system of scholarships was to ensure the peace of the world by bringing about closer understanding between young men of Great Britain and the British Empire and citizens of the United States and Germany. If one takes a short view, it might be said that Rhodes failed in his purpose. The two greatest wars in history have been fought since the Rhodes Scholarships were founded. But Rhodes did not take short views. In one of his letters he sets the period of a century as the time needed for giving his scholarships their full influence and effect, and in another document he lengthens this period to two centuries. Rhodes had the patience of great faith, but even in the short period of forty years it seems clear to any one who looks beneath the surface that the purposes he had in mind are already beginning to be fulfilled.

Anything like regimentation of opinion would have been contrary to Rhodes's character and to the character of Oxford. The American Rhodes Scholars have held, and hold, all varieties of opinion on national and international questions, and the German Rhodes Scholars likewise run through all the extremes, from one who is a member of Hitler's Cabinet to others who have refused to return to Germany so long as the Nazi régime exists. It is not fanciful to see in the influence of American Rhodes Scholars (an influence exerted as individuals, not as a group) a part of the reason for our closer understanding with England and a juster appreciation of the best in English education than we have ever had before.

Men who ponder anxiously about the future of the world are likely to feel strongly the importance of closer cooperation between the United States and the various countries which make up the British Commonwealth of Nations. Obstacles to such cooperation still exist, not the least of them being the Anglo-Saxon habit of rather too much frankness of criticism within the family circle. But any one who compares the situation now with what it was forty years ago can not but feel encouraged by the immense progress which has been made toward closer and friendlier understanding. Certainly, some part of the credit for this must be given to the generations of English and American students who have gone to and fro across the Atlantic and have formed ties of friendship and understanding in the universities of their sister lands.

Furthermore, if we take the long view, as Rhodes would have done, we may include as a part of the effect of his scheme the many systems of scholarships and fellowships which have been established partly at least as a result of his example. Taken all together, these represent a great cultural interchange between the United States and many of the leading countries of the world. Their effect can not be measured by statistics nor by any tangible, concrete evidence. On the high level of cultural interchange, however, it is the intangible things which count. When the war is won, the people of the United States, because of this intellectual exchange from which we have received so much, will face the future with a far more sympathetic knowledge of the character and aspirations of other peoples in other lands than we possessed twenty years ago—an understanding which, as we set about to build a new world upon the ruins of the old, may be expected to strengthen the foundations of peace and international order.

# SCIENTIFIC EVENTS

## COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH OF THE COMMONWEALTH OF AUSTRALIA

ACCORDING to the fifteenth annual report (for the year ended June 30, 1941) of the Council for Scientific and Industrial Research of the Commonwealth of Australia, a very considerable part of the council's activities is now devoted to the solution of problems arising out of the war and to assistance and advice to various government departments and other institutions and organizations which are concerned with the war effort. This applies particularly to the council's National Standards Laboratory, the Aeronautical Research Laboratory and the Forest Products Laboratory, and to the Division of Industrial Chemistry. The expenditure on this class of work forms a substantial part of the total expenditure of the council, but as no specific information which might be of value to the enemy can be disclosed, reference to these activities is either confined to brief generalized statements or is omitted entirely.

The Council for Scientific and Industrial Research was established in 1926 by the reorganization of the existing Institute of Science and Industry. The powers and functions of the council are defined by the Science and Industry Research Act 1920–39, and include the initiation and carrying out of research in connection with, or for the promotion of, primary and

secondary industries; the training of research workers; the making of grants in aid of pure research; the testing and standardization of scientific apparatus and instruments and the carrying out of scientific investigations connected with standardization; and the establishment of a bureau of information relating to scientific and technical matters.

With the outbreak of the war, the council immediately adopted the policy of reorientating as much as possible of its work into directions of value to the national war effort. As the war progresses, local production of necessary materials becomes more and more diverse and new emergencies bring new demands in their train. The number of opportunities for diversion of activities is thus an ever-increasing one until to-day a large percentage of the council's work is in connection with problems arising out of the war. As before stated, information which might be of value to the enemy can not be publicly disclosed.

In common with other organizations, a percentage of the council's staff has enlisted for one or other of the fighting services. Other officers have been seconded to the Munitions Department and other wartime departments for the period of the war. The chief of the Division of Forest Products and a senior officer of the Division of Industrial Chemistry, for instance, are assisting the Department of Munitions in the control of timber and industrial chemicals respectively; the council's assistant secretary (finance and supplies) is now acting as assistant secretary (administrative) of the same department. Other council officers have gone to other war departments where their training and experience are valuable. Those who are left are endeavoring to keep the former investigations going, particularly those of a long-dated nature on which time and money have already been spent. Here and there, however, it has proved necessary to cease work on projects until happier times arrive.

The total expenditure of the council during the financial year 1940–41 was £363,827, of which £70,996 was contributed from sources other than the Commonwealth Treasury. In addition, £8,000 was contributed by the Government of New South Wales for stone facing at the National Standards Laboratory, Sydney. The council is particularly gratified with the way in which the various contributing bodies continue to support it. Among the many contributions received, reference may be made to those of the Commonwealth Bank, the Australian Wool Board, the Australian Cattle Research Association, the George Aitken Pastoral Research Trust, the Dried Fruit Control Board and the New South Wales Water Conservation and Irrigation Commission.

## WORK ON INFANTILE PARALYSIS AT THE JOHNS HOPKINS UNIVERSITY

ANNOUNCEMENT of a five-year grant of $300,000 to the Johns Hopkins University for an intensive and long-time study of the disease of infantile paralysis has been made by Basil O'Connor, president of the National Foundation for Infantile Paralysis.

This is the largest single grant made by the foundation since it was organized in 1938. It will be used to establish and conduct the Center for the Study of Infantile Paralysis and Related Viruses at the university. The funds which make this and other research projects of the foundation possible are contributed each year at the time of the national celebration of the President's birthday.

In announcing the grant, Mr. O'Connor said:

> The establishment of this center at the Johns Hopkins University is the product of the ideas of many investigators who, after years of research experience in the field of infantile paralysis, keenly felt the need for a center in which the talents of numerous scientists with widely diverse backgrounds could be pooled in a concentrated attack upon the problems of the disease. In addition to the separate research work of individuals now supported by the National Foundation in leading institutions throughout the country, there has been a need for units in which all the problems of poliomyelitis could be studied on a comprehensive scale and on a long-time basis. The Johns Hopkins University offers an ideal place for such a center, as a large number of the required staff of epidemiologists, virologists, serologists, neurologists and chemists acquainted with the problems presented by poliomyelitis are available there.
>
> In view of war conditions it is highly desirable, if it can be accomplished without sacrificing defense interests, to keep a nucleus of scientists at work on the problems of infantile paralysis which are so important to human welfare, with the hope that, when peace is established, contemplated expansion in this field may be rapidly consummated.

Work at the center will be under the direction of Dr. Kenneth F. Maxcy, professor of epidemiology in the School of Hygiene and Public Health. Dr. Maxcy will be assisted by a competent group of investigators, some of whom already have made significant contributions to research in this field. Three members of the staff have been appointed and have begun their work. They are Dr. Howard A. Howe and Dr. David Bodian, formerly of the department of anatomy of the Johns Hopkins School of Medicine, and Dr. Robert C. Mellors, biochemist from Western Reserve University.

In setting up the center, adequate laboratory space and facilities have been provided and the resources of the new grant will permit the investigators to carry on their studies in the field as well as in the laboratory

as opportunity may be presented. The ultimate objective is to gain a more complete understanding of the spread of the poliomyelitis virus not only within the human body, but in the community, from one individual to another.

## COMMONWEALTH FUND FELLOWSHIPS IN MEDICINE AND PUBLIC HEALTH

THE Commonwealth Fund of New York announces that it is offering through the Pan American Sanitary Bureau fifteen fellowships for one year's study of public health subjects or postgraduate medical courses to properly qualified persons who are citizens of the other American republics. Fellowships in public health will be open to physicians, sanitary officers, technicians, public health nurses, etc. These fellows will be selected through a system of cooperation with medical and health authorities of the different countries concerned, and whenever deemed advisable they will be interviewed by traveling representatives of the Pan American Sanitary Bureau. Each fellowship will provide living allowances while the holder is in the United States, travel costs and tuition. Knowledge of the English language will be among the requirements, and also the possession of certain specific qualifications.

The Pan American Sanitary Bureau, the international health agency of the American republics, has been for some time the recognized clearing house for medical and public health fellowships in the United States, nearly a hundred Latin Americans now being in the United States under its auspices.

Application blanks giving complete information are available through the Commonwealth Fund, 41 East 57th Street, New York; the Pan American Sanitary Bureau, Washington, D. C.; or chiefs of American Missions in Latin America.

## RADIO PROGRAMS ON THE WAR WORK OF ENGINEERS

ACCORDING to an announcement made public by Dr. R. L. Sackett, of the American Society of Mechanical Engineers, who is a member of a committee representing the national engineering societies, the National Broadcasting Company, beginning on Thursday, July 16, will broadcast from 6:30 to 6:45 P.M. over its nation-wide network and possibly also by short wave a series of eleven radio programs dealing with the contributions of engineers to the prosecution of the war.

According to Dr. Sackett, the idea of telling the world by radio about engineers and their war activities came from a series of radio programs put on the air in 1941 by the American Institute of Electrical Engineers. The success of this series led the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Institute of Chemical Engineers to appoint three representatives of each society to form a committee to consider a possible program and report to each society.

The program is as follows:

July 16. Blackouts. Representative of OCD and Samuel G. Hibben, Westinghouse Electric and Manufacturing Co.

July 23. Protection Against Incendiary Bombs and Gas. Sidney D. Kirkpatrick, president of the American Institute of Chemical Engineers, and Dr. Arthur Ray.

July 30. The Resistance of Structures. Professor H. E. Wessman, New York University, and Walter D. Binger, commissioner of works, Manhattan.

August 6. The Navy. Ships. Admiral S. M. Robinson.

August 13. Dry Docks and Ship Repair Bases. Rear Admiral Ben Moreell.

August 20. Tanks and Tools. Prepared by Chrysler Corporation.

August 27. Airplanes. Prepared by Wright Aeronautical Corporation.

September 3. Petroleum Production. Prepared by Robert E. Wilson, president, Pan American Petroleum Company.

September 10. Power—Hydro, Steam, Electric. Glen B. Warren, General Electric Company, and others.

September 17. U. S. Engineers Corps in Peace and War.

September 24. Communications in Action.

## HONORARY DEGREES CONFERRED BY HARVARD UNIVERSITY

AS already recorded in SCIENCE, the honorary degree of doctor of science was conferred at the commencement of Harvard University on Professor Reginald Aldworth Daly, Dr. René Jules Dubos and Dr. Adolf Meyer. The citations read:

REGINALD ALDWORTH DALY: A geologist of rare imagination and wide vision, his enthusiasm has aroused physicists, chemists and astronomers to cooperate in the advancement of his science.

RENÉ JULES DUBOS: A penetrating student of the chemistry of bacteria, from one group of microorganisms he isolates potent compounds which will kill another.

ADOLF MEYER: For many years the leader of psychiatrists of the United States; a pioneer in applying the techniques of medicine to the diagnosis and treatment of mental ailments.

The doctorate of laws was conferred on Dr. Frederick Paul Keppel with the citation:

Wise in his understanding of the needs of education and the arts; under his guidance the Carnegie Corporation has shown how private philanthropy may sow a rich harvest for the nation.

# SCIENTIFIC NOTES AND NEWS

DR. JOSEPH HAINES MOORE has been appointed director of Lick Observatory, University of California. He became a member of the staff of the observatory in 1903, and has been since 1936 assistant director. He succeeds Dr. William H. Wright, who, having reached the age of sixty-five years, retired on July 1. Dr. Wright retains the rank of astronomer and expects to continue his work at the observatory.

PRESENTATION of the Janeway Medal of the American Radium Society was made on June 8 at the Atlantic City meeting to Dr. William P. Healy, specialist in nervous and mental diseases and director of the Judge Baker Foundation, Boston. The medal was awarded in recognition of "outstanding contributions in the field of radium therapy." Dr. Healy delivered the Janeway Lecture, which was entitled "The Role of the Gynecologist in the Field of Cancer."

DR. CLYDE L. CUMMER, assistant clinical professor of dermatology and syphilology at the Western Reserve University School of Medicine, a member of the faculty since 1909 and a former president of the Ohio State Medical Association, has been awarded the 1942 distinguished service award of the Academy of Medicine of Cleveland.

THE College of Physicians of Philadelphia awarded on July 14 the Alvarenga Prize to Dr. Edwin J. Cohn, professor of physiological chemistry at Harvard University, in recognition of his distinguished contribution to our knowledge of blood proteins. This prize was established by the will of Pedro Francisco DaCosta Alvarenga, of Lisbon, Portugal, an associate fellow of the College of Physicians, to be awarded annually on each anniversary of his death, July 14, 1883, "to the author of the best memorial upon any branch of medicine, which may be deemed worthy of the prize."

AS already announced in SCIENCE, Dr. George H. Shull, professor of botany and genetics at Princeton University, was given the degree of doctor of science at the commencement exercises on June 5 of Iowa State College. At the same time, the degree of doctor of engineering was conferred on Wilbur M. Wilson, research professor of structural engineering at the University of Illinois; the Marston Medal was awarded to LeRoy L. Hidinger, of the Morgan Engineering Company, Memphis, Tenn., in recognition of his work in drainage of the Gulf Coast.

AT the Boston convention of the American Home Economics Association, the Borden Company's award of $1,000 was given to a group of five investigators for their cooperative research in milk nutrition. They are: Dr. Margaret Ohlson, of Iowa State College; Dr. Ruth Leverton, of the University of Nebraska; Miss Hughina McKay, of the Ohio State University; Dr. Martha Pittman, of Kansas State College, and Dr. Genevieve Stearns, of the State University of Iowa.

DR. R. C. NEWTON, vice-president and chief chemist of Swift and Company, Chicago, was elected president of the Institute of Food Technologists at the recent Minneapolis meeting.

NATIONAL officers of the American Association of Scientific Workers have been elected as follows: *President,* Kirtley F. Mather, Harvard University; *Vice-presidents,* Bart J. Bok, Harvard University; Henry Borsook, California Institute of Technology; Watson Davis, Science Service; Ralph W. Gerard, University of Chicago; Lloyd A. Jeffress, University of Texas; Oscar K. Rice, University of North Carolina; *Secretary,* Harry Grundfest, Rockefeller Institute for Medical Research, New York City; and *Treasurer,* Melba Phillips, University of Minnesota.

DR. MINTIN ASBURY CHRYSLER, of Rutgers University, has been made research professor emeritus in the department of botany. The collection of plants of the department has been designated "The Chrysler Herbarium of Rutgers University." Dr. and Mrs. Chrysler were honored on April 16 at a seminar and dinner given by their friends and colleagues at which Dr. W. H. Camp, of the New York Botanical Garden, spoke on "The Herbarium in Systematics." Professor Chrysler will continue his morphological studies on Central American ferns.

THE retirement is announced of Dr. Geo. Harrison Shull, since 1915 professor of botany and genetics at Princeton University.

DR. ALFRED J. WAKEMAN, for thirty years a member of the department of biochemistry at the Connecticut Agricultural Experiment Station, has retired. At the Experiment Station, he was associated with Osborne and Mendel in their work on the nutritive properties of proteins and in early studies on the preparation of vitamin concentrates.

DR. FRANK T. MCFARLAND, head of the department of botany at the University of Kentucky, has been relieved at his own request of administrative work in order that he may devote more time to teaching and research; Dr. Herbert P. Riley, associate professor of botany at the University of Washington, will succeed him as head of the department.

AT the State University of Iowa, Dr. Kenneth W. Spence, since the death of Dr. John A. McGeoch temporary chairman of the department of psychology, has been made chairman; Dr. Robert R. Sears has

been appointed head of the Iowa Child Welfare Research Station to succeed Dr. George D. Stoddard, now New York State Commissioner of Education, who was also dean of the Graduate College. As already reported, Dean Emeritus Carl E. Seashore is serving as *interim* dean until a successor to Dr. Stoddard is appointed.

EUGENE C. MCKIBBEN, professor of agricultural engineering at Iowa State College, has been appointed head of the department of agricultural engineering at Michigan State College.

EDWIN D. MCKEE, assistant director of the Museum of Northern Arizona, will be loaned to the department of geology of the University of Arizona for an eight-month period beginning in September and ending in May, 1943.

AT the Scripps Institution of Oceanography of the University of California, La Jolla, Dr. Denis L. Fox has been advanced to the rank of associate professor of marine biochemistry. Dr. Claude E. ZoBell, who has been promoted to an associate professorship of marine microbiology, is serving also as acting director of the institution in the absence of Dr. H. U. Sverdrup.

DR. PHILIP D. WOODBRIDGE, of the Lahey Clinic, Boston, has become professor of anesthesiology at the Temple University School of Medicine, Philadelphia.

THE department of zoology of Columbia University has established an advisory committee, and the following have been asked to serve by President Butler: Professor H. B. Goodrich, Wesleyan University; Professor E. Newton Harvey, Princeton University; Professor Donald E. Lancefield, Queens College; Professor Charles W. Metz, University of Pennsylvania; Dr. Hermann J. Muller, Amherst College; Dr. William Procter, Bar Harbor; Professor Alfred S. Romer, Harvard University; Professor Francis B. Sumner, Scripps Institution of Oceanography, and Professor L. L. Woodruff, Yale University.

DR. JAMES F. MARTIN, senior pathologist of the Bureau of Plant Industry, has been appointed to succeed Dr. Stanley B. Fracker as chief of the division of plant disease control of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture. Dr. Fracker has been appointed research coordinator on the staff of Dr. Eugene C. Auchter, agricultural research administrator.

DR. GREGORY JAMIESON COMSTOCK, professor of powder metallurgy at the Stevens Institute of Technology, has been appointed technical consultant of the United States Board of Economic Warfare in the Industrial Engineering Division.

THE *Journal* of the American Medical Association states that a field investigation of encephalitis is being conducted in Pinal County by Dr. William McD. Hammon, of the George Williams Hooper Foundation of the University of California, San Francisco, and Dr. Gordon Meiklejohn and Bernard Brookman, entomologist, both of the University of California at Berkeley. The State Department of Health and the Agricultural Welfare Association are cooperating with the hospital in Casa Grande, where field headquarters have been established.

FOOD RESEARCH LABORATORIES, INC., Long Island City, N. Y., announces the appointment of Dr. Raymond C. Bender to its technical staff as nutritionist in charge of the bioassay laboratories. Dr. Bender formerly was research chemist with the Borden Company at Bainbridge, N. Y., and has more recently been connected with the Harris Laboratories, Inc., of Tuckahoe, N. Y.

DR. PHILIP LEVINE, bacteriologist and serologist of the Newark Beth Israel Hospital, gave recently a lecture on "Serological Differentiations of Human Blood" as the first lecture sponsored by the newly organized Charles Fremont Dight Institute for the Promotion of Human Genetics at the University of Minnesota.

THE Division of Petroleum Chemistry of the American Chemical Society, which, on account of the pressure of war work on its members, had decided not to hold sessions at the Buffalo meeting of the society, now expects to hold its regular meeting there, together with the other seventeen divisions of the society.

THE American Dental Association and the American College of Dentists will hold their annual meetings in Boston, the former from August 24 to 28 and the latter on August 23. Headquarters for both societies will be the Hotel Statler.

RESEARCH workers seeking instruments required in their work but difficult to find are invited to communicate with D. H. Killeffer (60 East 42d St., New York, N. Y.), chairman of the newly appointed Committee on the Location of New and Rare Instruments of the National Research Council. The plan is to assist in locating needed instruments of types not ordinarily available through usual channels. Assistance is particularly desired from owners and builders of instruments falling within the new or rare categories which might be made available to others through sale or for temporary use under mutually satisfactory conditions.

ACCORDING to *The Johns Hopkins University Gazette*, it is estimated that nearly a thousand Hopkins men are now in the armed services. This estimate is based on an actual count of 832 Hopkins men in the Army, Navy, Marine Corps and Coast Guard. A breakdown shows that 622 hold commissions, while

210 are non-commissioned officers or privates. The largest single classified group are the medical officers, of whom there are more than 200, about three quarters of them serving in the Army and a quarter in the Navy. Thirty hold commissions in the Air Services, twenty-four in the Army and six in the Navy. Only eleven Hopkins men are known to be in the Coast Guard, eight of them commissioned officers and three of lower rank. Four hold commissions in the Marine Corps. From this year's graduating class, thirty-seven will receive reserve commissions in the Army as a result of completing the R. O. T. C. course. Many others will enter training schools to prepare for commissions in both Army and Navy. It is probable that nearly half the graduates will go immediately into the armed forces, while the other half will go into wartime industries or advanced training in medicine, chemistry, physics or other essential fields.

Two fellowships are available in the department of geology of the Massachusetts Institute of Technology in the fields of mineralogy and structural crystallography. One of these, a teaching fellowship, carries a stipend of $500 per academic year plus free tuition. Up to eighteen hours per week may be required of the holder of this fellowship. Another fellowship, concerned chiefly with carrying out investigations in structural crystallography and allied fields, requires an investigator with a fairly good background in crystallography and preferably having had some experience in the x-ray study of crystal structures. This fellowship, which is of a more permanent nature, requires the full time of the incumbent and carries a stipend of about $2,000. Any one interested in these fellowships should communicate with Professor M. J. Buerger, Department of Geology, Massachusetts Institute of Technology, Cambridge, Mass., giving full details regarding their qualifications.

A FELLOWSHIP fund, amounting to $500 a year for the next ten years, has been established at the University of Kentucky for students in either mechanical engineering or industrial chemistry as a gift from the Ashland Oil and Refining Company. The fellowship will be awarded on the basis of scholarship and need.

THE American Standards Association has announced completion of a new emergency standard which, while intended for the Army and Navy, will help amateur photographers all over the country to take better pictures. The new standard is a photographic exposure computer—a simple pocket-size device for finding the correct exposure for any time of day in any habitable part of the world. It was prepared at the request of the U. S. Navy for use on ships and planes by the Army and Navy, but it will also be issued in a civilian edition which may be obtained and used by any amateur photographer. The civilian edition is identical with the Army and Navy edition, except for use of priority materials required by the services because of rigorous conditions.

# DISCUSSION

## FURTHER DATA ON THE CULTIVATION OF TOBACCO AMONG THE PUEBLO INDIANS

IN "*Nicotiana rustica* Cultivated by Pueblo Indians," in SCIENCE for July 18, 1941, I reported upon the discovery of this species of tobacco under cultivation in one of the Indian pueblos in New Mexico. This find seemed significant first, because of the extreme paucity of evidence for any cultivation at all among the pueblos, and, secondly, because a previous survey of aboriginal tobaccos[1] did not place *N. rustica* in the Southwest. Since last July new data have come to light; they illuminate our problem, but leave it still unsolved.

Last summer I collected specimens of tobacco, all under cultivation, at Santo Domingo, Cochiti and Jemez pueblos, and at the little Mexican town of San Ysidro, the first two being located in the Rio Grande valley, the latter two in the valley of the Jemez. These specimens were identified by Mr. Volney H. Jones,[2] of the University of Michigan, and by Professor T. H. Goodspeed, of the University of California, as *N. rustica,* Professor Goodspeed adding that they closely resemble a variety called *pumila.* Dr. H. P. Mera, of the Laboratory of Anthropology at Santa Fe, and Mr. Pete Gonzales, also of Santa Fe, sent me a specimen of *punche* (the local Mexican name for tobacco) seed, grown in Rio en Medio, near Santa Fe. This seed appears to be *N. rustica,* but definitive identification should be made from plants grown from them.

From 1925 to 1931, The Consumer Tobacco Company, Mr. R. G. Mewborne, president, grew *N. rustica* experimentally and extensively near Albuquerque. I have discussed this project with Mr. Mewborne at some length. He told me that he used to give seeds freely to Indian and Mexican farmers who "preferred this kind of tobacco to the kind they were growing." Dr. E. G. Beinhart, of the U. S. Department of Agriculture, also had plots of *N. rustica* grown experimentally near Albuquerque between 1926 and 1929.[3] Thus

[1] Wm. A. Setchell, *Am. Anthropologist,* 23: 397–414, 1921.

[2] I am greatly indebted to Mr. Jones for aid and counsel at every point in this investigation.

we see clearly how this species may have been introduced into the pueblos. But our problem is not solved with this new evidence. Tobacco was unquestionably cultivated in the Pueblo country, by Indian and Spanish farmers alike, for decades before these recent experiments. The question is, What species of tobacco was this, and what is its history?

Mr. Mewborne tells me of seeing tobacco under cultivation in New Mexican villages in the early 1900's. Dr. H. P. Mera reports that he has seen tobacco grown near Santa Fe 25 or 30 years ago. Mr. Pete Gonzales also informs me that *punche* has been grown in Rio en Medio since "1875, at least." But we do not know what species of *Nicotiana* are involved in these instances of cultivation.

Through the kindness of Professor Clyde Kluckhohn, of Harvard University, a manuscript in the Peabody Museum by Dr. Edw. Palmer, who made extensive botanical collections in the Southwest for many years prior to 1890, was examined for references to *N. rustica* among the pueblos.[4] None was found. Dr. Beinhart, Dr. Rogers McVaugh, also of the U. S. Department of Agriculture, and Mr. Volney H. Jones have made search among Palmer's field notes and elsewhere, but without discovering any evidence of *N. rustica* under cultivation among the pueblos.

Further inquiry among documentary historians supports Bandelier's claim that "tobacco was not known to the Pueblos until Spanish rule became established."[5] Archeologists have no evidence of the use of tobacco among the Pueblos in prehistoric times.

The situation, then, seems to be this: Tobacco was not used among the Pueblos prior to the advent of the white man. All our specimens, collected subsequent to the experiments of Mr. Mewborne and Dr. Beinhart, are of *N. rustica,* and hence may have been introduced by them. But tobacco of some species was grown in the Mexican villages and Indian pueblos of this region for decades before 1925. Was this species also *rustica*? If another species, has its cultivation been discontinued, possibly as a consequence of recent introduction of *rustica*? Or, is it still being grown to-day? These and other questions must be answered before we can write the history of tobacco cultivation in the Southwest.

P.S.—Since the above was written, "Three New Mexico Chronicles," translated and edited by H. Bailey Carroll and J. Villasana Haggard, has been published by The Quivira Society (University of New Mexico Press, Albuquerque, 1942). In this work we find two references to the cultivation of tobacco in New Mexico in the 19th century. The first, from a treatise by Juan Bautista Pino, published in 1812, states that tobacco was cultivated in New Mexico at that time but that its production was limited by a government monopoly (p. 97). The second reference is from notes on New Mexico by José Agustín de Escudero, published in 1849, which states that "a kind of tobacco which the Indians call *punche*" was grown "but which its producers can not sell because of the government monopoly" (p. 120).

LESLIE A. WHITE

UNIVERSITY OF MICHIGAN

[3] E. G. Beinhart, SCIENCE, 94: 538–39, December 5, 1941.

[4] Geo. Vasey states that Palmer observed *N. rustica* under cultivation among the Indians of New Mexico (Report of the Botanist, p. 76, in Report of the Commissioner of Agriculture for 1886), but all effort to find this statement in Palmer's notes, unpublished as well as published, has failed.

[5] Final Report, etc., Pt. I, p. 37 (Papers of the Archeological Institute of America; Amer. Series III; 1890).

## BREEDING DISEASE-RESISTANT CROPS

IN a recent article Stevens[1] pointed out that the production of new varieties of crops, even those bred for resistance to some important disease, often prove to be very susceptible to some other disease which, even with extensive testing, might not be discovered by the breeder prior to its release. This has happened so often that it has come to seem almost axiomatic to many people.

The danger of introducing a gene for susceptibility to some other disease while introducing one or more for resistance to the disease under consideration may be avoided by using the backcross method of breeding.[2] In a self-pollinated crop like wheat the progeny of a hybrid will become homozygous for the genes of the recurrent parent with a sufficient number of backcrosses. Only the gene or genes being introduced must be maintained by selection. Therefore, the new variety will be exactly like the recurrent parent except for the introduced genes and perhaps some other very closely linked ones.

We have used this method in breeding wheats resistant to bunt, *Tilletia tritici,* and to stem rust, *Puccinia graminis,* and find that the derived varieties are exactly like the recurrent parent in all characters except for resistance to the two diseases mentioned. Their reaction to mildew, septoria, leaf rust and other diseases has not been changed.

In cross-pollinated crops, like corn, backcrossing to a heterozygous parent is equivalent to one generation of inbreeding; therefore, this method of breeding may not be so directly applicable, especially if such a crop loses vigor when inbred. In the case of corn it should be very useful in improving inbred lines.

FRED N BRIGGS

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[1] Neil E. Stevens, SCIENCE, 95: 313–316, 1942.
[2] Fred N Briggs, *Amer. Nat.,* 72: 285–292, 1938.

## WEATHER FORECASTS

IN the issue of SCIENCE for May 8, page 479, there a little slip in the item "Weather Forecasts," by D. Davidson. To disprove the notion that "the air heavy with moisture" when it is going to rain, the rst reason given is "because of the molecular weights water and of the hydrogen-oxygen mixture." Pre-mably this should have read "nitrogen-oxygen" ixture.

The erroneous idea that moist air is heavier than ry air probably is due in part to the assumption that ir absorbs moisture very much as a sponge absorbs ater, and that moist air, therefore, should consist of e original volume of air plus the added water vapor nd should weigh more than the dry air alone. What ctually occurs, of course, is that the water vapor dis-places an equal volume of air. Since water vapor is ghter than air any mixture of the two will weigh ss than the same volume of dry air under the same ondition of temperature and pressure.

B. E. SCHAAR

CHICAGO, ILL.

## PER CENT.

DR. ELLIOTT[1] has made a much needed plea that nstead of using the ambiguous term "per cent.," uthors should indicate exactly what they mean when hey state the concentrations of their solutions. In his connection it might be well to mention the official anction which has been given by the U. S. Pharma-copoeia to the usually more useful definition of the erm per cent. The eleventh edition of the U.S.P. efines it for solutions of solids or gases in liquids s grams per hundred cubic centimeters of solution, nd for liquids in liquids as cc per 100 cc of solution, hen not otherwise qualified.

Another source of confusion, not mentioned by Dr. Elliott, is the use of per cent. to refer to dilutions f a concentrated solution. A solution of HCl pre-pared by diluting 10 cc of conc. HCl to 100 cc with ater, is not a 10 per cent. solution (or even a 1:10 olution).

FERRIN B. MORELAND

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## HEALTH AS A NATIONAL ASSET

IN the magazine, *Britain To-day,* which apparently erves the purpose of promoting amity and cultural elations among English-speaking people, Sir George Newman, formerly chief medical officer of the Min-stry of Health, published an article on "Health as National Asset." In this article he states that mod-rn English medicine was mainly established by seven particular events, among which he lists the discovery f anesthesia by Humphry Davy and Simpson.

It happens that both Davy and Simpson were Brit-ishers and both contributed materially to the advance-ment of science and medicine. Davy, who at the age of nineteen was employed in the laboratory of the Pneumatic Institute of Thomas Beddoes in Clifton, made some interesting observations on the recently discovered gases—carbon dioxide and nitrous oxide. He used nitrous oxide on various animals, as well as on himself, and observed the pleasant feeling of in-ebriation as well as the suppression of pain percep-tion resulting from the inhalation of this gas. Due to its exhilarating actions he very properly termed nitrous oxide as laughing gas and remarked that "as nitrous oxide in its extensive operation appears capa-ble of destroying physical pain, it may probably be used to advantage during surgical operations in which no great effusion of blood takes place." (1799.)

It may be added that Davy's chief, Beddoes, made the same observation concerning ether—an observa-tion which was amply confirmed by Faraday and other British and American observers. It is fair to state, however, that these isolated observations re-mained mere scientific curiosities and remained un-heeded for a long time by surgeons in general and the British medical profession in particular and that they have not accomplished what Sir George New-man implies—the establishment of modern English medicine.

The other name mentioned by Sir George Newman is that of Sir James Young Simpson. Simpson was a well-known obstetrician and woman specialist who first used ether to alleviate the suffering of child-birth after ether had been successfully used in America by a number of surgeons and introduced into the British Isles by Bigelow. Simpson is also responsible for the introduction of chloroform into the practice of sur-gery after its action in animals had been discovered by the great French physiologist, Flourens.

These very interesting observations and discoveries have little to do with the discovery of anesthesia for surgical operations, which is a purely American con-tribution. Whether the credit for this great discovery should be given to Crawford W. Long, of Jefferson, Ga., or to William T. G. Morton is a debatable ques-tion, although it is certain that Long preceded Morton but that Morton had the good fortune of having dem-onstrated the efficacy of ether in the operating room of the Massachusetts General Hospital to the satisfac-tion of the leading surgeons of the day (October 16, 1846).

It is the American discovery of anesthesia and its successful demonstration by Morton that influenced English and other medicines, because within a year after this demonstration ether was used throughout the civilized world and "strong men" were no longer needed to hold down the tortured, struggling patients

[1] K. A. C. Elliott, SCIENCE, n.s., 95: 123, 1942.

during operations. American pharmacologists and physicians will rightly wonder where Sir George obtained his information of the discovery of anesthesia and whether his particular brand of information did a service to the cause of the Anglo-American scientific alliance.

THEODORE KOPPANYI

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## CEMENTING SINO-AMERICAN FRIENDSHIP

IN the April 17 issue of SCIENCE was an appeal by Morris F. Shaffer to cement the bonds between Chinese and American scientists the same as is being done between American and British scientists. In the spirit of this appeal I recently turned over to a Chinese student of algae a number of reprints on subjects in his field. His deep appreciation of this contribution to the rebuilding of his working library, which was lost to the Japanese in Hongkong, indicates a concrete way American scientists can express their desire to "preserve the scientific heritage of the whole world against the barbarism and obscurantism of Fascist ideology."

Few scientists keep all the reprints and other scientific publications which they receive. This discarded material, however, is a potentially valuable nucleus for the rebuilding of private and institutional libraries now lost or to be lost or destroyed as a result of the present war. As China could live on what America wastes, so Chinese scientists could thrive on what we throw away. Because the nation-wide campaign to gather waste paper may be instrumental in destroying much potentially valuable scientific literature, it would seem appropriate for all internationally minded scientists to begin now to lay aside the material they do not want so that it may be assembled and put to use at the end of the conflict now raging. There is at present no organization receiving and storing such unneeded literature for future distribution, but if every one will make such an accumulation, surely some organization will eventually take over the task, and this material will become a useful tool in the rebuilding of a better world and in cementing the ties between American and Chinese scientists.

EGBERT H. WALKER

SMITHSONIAN INSTITUTION

# QUOTATIONS

## CONTRIBUTIONS TO SCIENCE OF THE JOHNS HOPKINS UNIVERSITY

A NEW and striking picture of the scientific leadership of the university is offered by a survey of "American Men of Science," a biographical dictionary containing in its latest edition 28,000 names, selected for proven scientific achievement.

By a nation-wide vote, about five per cent. of those named have been starred for special distinction. Taking chemistry as representative of the sciences, one finds that stars have been awarded to 209 men who have received their doctor of philosophy degree at American educational institutions. Of these 209, 165 received their degree at privately endowed institutions and only 44 at state-supported universities.

Five institutions alone boast 126, or substantially more than half, of the starred names. And of these five, Harvard, Chicago, Yale, Columbia and Johns Hopkins, Johns Hopkins is the highest! Johns Hopkins has 31, Harvard 28, Chicago 23, Yale 23, and Columbia 21.

That the Hopkins' scientific leadership has been felt long in America's key industries is no secret. The first laboratory for research on petroleum was started by a Hopkins graduate. Other Hopkins scientists since then have devoted their efforts to improving upon refining processes.

In addition, an increasing amount of time now is being devoted by Hopkins men to fundamental problems of the petroleum industry, such as studies upon the origin of petroleum and the problem of possible exhaustion of reserves: new and unexpected methods are being discovered for producing high-grade gasoline from agricultural products.

The mechanism of the cracking process is being examined and the applications of catalysis to the production of better fuels and lubricants are being considered. In the present emergency, especial emphasis is being placed by Hopkins researchers upon the production of improved aviation fuels, usually by the processing of low-grade fuels, and upon the study of processes of wear and corrosion, which attack the life of military machines.

Other alumni are working hard on the exploitation of coal-tar and petroleum by-products, pharmaceutical products, the food industries, and in special applications, such as solvents, lacquers, refrigerants, antifreezes, explosives, flavors, perfumes, fertilizers, insecticides, dyes and photography.

Much research, in fact, is going on at the Homewood campus, itself. So secret are these studies and so vital to the national security that armed guards now patrol the grounds surrounding the chemistry and physics buildings.

Hopkins graduates and the university's faculty alike are playing an important role in America's all-out war effort.—*The Johns Hopkins University Gazette.*

# SCIENTIFIC BOOKS

## THERMODYNAMICS

*The Nature of Thermodynamics.* By P. W. BRIDGMAN. xii + 229 pp. Cambridge, Mass.: Harvard University Press. 1941. $3.50.

ANY book dealing with the philosophic aspects of physics from the pen of Professor Bridgman is something which students of the subject may expect to read with profound interest. Thermodynamics is to many a confusing subject, a subject in which the student is apt to become familiar with the technique of manipulation of the formulae which lie in his own particular territory without any very clear concept of the fundamentals underlying the operations concerned. Mathematical physics frequently develops a kind of inertia of technique which enables really valuable discoveries to be made without the discoverer really knowing what he is doing. It is, therefore, refreshing occasionally to have the complacency of mathematical technique disturbed by an inquiry as to the significance of the assumptions involved and of the operations carried out. Professor Bridgman attempts such an inquiry in his book.

The book itself is divided into four chapters, the first entitled: "The First Law of Thermodynamics and the Concept of Energy"; the second, "The Second Law of Thermodynamics"; the third, "Miscellaneous Considerations," and the fourth, "Retrospect and Prospect." It is naturally impossible to review in detail the enormous number of points discussed. A general attempt is made to analyze the meaning of such concepts as the transportation of energy from place to place in terms of what the picture of the said energy might be supposed to be in terms of the matter which possesses it. The spirit of the inquiry is exemplified by such questions as Professor Bridgman asks in connection with heat regarded as a "thing." "The whole situation," writes Professor Bridgman, "with regard to flow is evidently embarrassed by strong verbal impulses: we find it difficult to say 'There is flux at this point' without wanting to say also 'Something is flowing at this point,' and if something, then there is velocity and a density. To what extent is the impulse verbal that demands a velocity if there is a 'thing'?"

In another place the unsophisticated will be disturbed to find flux of energy in the opposite direction to the motion of the matter which carries it. Again, in connection with the first law of thermodynamics a careful consideration is given of just what is meant by measurement of work and quantity of heat, and the conclusion well known to the more sophisticated, but coming as a surprise to the naive, is voiced in the insistence that the primary content of the first law is comprised in the statement that the sum of the differential elements of heat added to a system and work performed upon it form an exact differential of suitably chosen coordinates.

Many questions are raised as to the significance of the allocation of energy in different places and entities in physics. Thus Professor Bridgman writes: "I can not help feeling that in some places there is a trace of mysticism left in the verbal impulse to say, 'Matter and energy are *really* the same thing.'" The implications of the second law of thermodynamics are discussed in the same detailed manner. We have Maxwell's demon subjected to a closer scrutiny as regards his mental processes than he has been accustomed to receive, and the general question of the assumption of specialized conditions in thermodynamical proofs is discussed in its relation to the extent to which such idealizations may themselves be inconsistent with the requirements of the second law.

Naturally, any one who has thought along lines paralleling those discussed by Professor Bridgman would find many points in which he would be inclined to raise minor arguments, but any differences of opinion of this kind would naturally be on a high plane of sophistication. Again there are many other matters of analogous nature to those covered in Professor Bridgman's book which invite attention, but any one who has been accustomed to take thermodynamics at its face value and use it merely as a tool will have his horizon of understanding greatly enhanced by a consideration of even a few of the points raised in this most interesting volume.

## PHYSICAL AND CHEMICAL CONSTANTS

*Tables of Physical and Chemical Constants and Some Mathematical Functions.* Ninth Edition. By G. W. C. KAYE and T. H. LABY. 181 pp. London, New York, Toronto: Longmans, Green and Company. 1941. $5.00.

THOSE who have been accustomed to use Kaye and Laby's "Tables of Physical and Chemical Constants" will welcome the appearance of this revised edition, which, while retaining the features which characterized the usefulness of the previous editions, is amplified so as to include data pertaining to modern researches—nuclear physics, etc.—as well as additional material pertaining to the older branches of physics.

The book is characterized by the ease with which it is possible to ascertain the exact meaning to be attached to the data given, and frequently a preliminary summary of the physical laws associated with the data is given in condensed form but with a completeness adequate to remind the reader of the exact significance of the data themselves. Indeed, there is quite a little physics contained in the Tables, but it is not allowed to dominate the situation in such fashion that one is unable to find the wood for the trees. So frequently

a Table of Physical Constants, in an attempt at completeness, requires a preliminary study of the book itself in order to ascertain how to use it. Kaye and Laby's book is free from this defect.

As before, useful mathematical tables are included at the end, and certain useful formulae, such as formulae for the moments of inertia, are to be found in the work.

All in all, this volume is one of the most useful books, for the purpose for which it is intended, with which this reviewer is acquainted.

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## SENSATION AND PERCEPTION

*Sensation and Perception in the History of Experimental Psychology.* By EDWIN G. BORING. xv + 644 pp. New York: D. Appleton-Century Company, 1942.

THIS important book is really the second volume of the distinguished author's "History of Experimental Psychology." The first volume, published in 1929, traced the origin and development of scientific outlook and method in psychology, and dealt with the men and the schools without detailed attention to the results achieved. The present volume traces the growth of scientific knowledge, including the specific methods and theories, in one important part of the subject, as indicated in the title, and we may hope for at least one more volume on other topics similarly treated.

The scope of this volume is not limited to those who have been known as psychologists during the past eighty years. It goes behind them to the days when there was no distinct science of psychology. "The formal distinction between psychology, physiology and physics is but a product of the scientific specialization of the nineteenth century. . . . The first important knowledge of color and its stimulus was contributed by Newton, of visual space perception by Kepler, of the tonal stimulus by Galileo. These problems, which the psychologists now claim, had meaning and importance for the great natural philosophers of the seventeenth century. They were neither physics nor psychology then; they were philosophy" (p. 97). Until well along in the nineteenth century the most important contributions were made by physicists and sense physiologists, and names like Helmholtz, Hering and Wheatstone are bound to appear prominently in the history. Even after the establishment of psychological laboratories, the physiologists and physicists by no means lost their interest in the senses but continued to make important discoveries. A book like this one, in tracing the development of knowledge, could not and does not attempt to separate the contributions of the several sciences. Any one desiring to reach a critical appraisal of the achievements of experimental psychologists as such would therefore have to sift the material rather carefully, as could be done by aid of the excellent annotated bibliographies supplied by the author. He would find, especially in the recent decades (though the author does not usually attempt to bring the story down to the very present), that the psychologists have been doing their share of the work.

The author begins with a brief account of general theories of sensation and perception, in their historical development, and follows with a condensed but informative history of the "physiology of sensation," including the distinction between sensory and motor nerves, the nature of nerve conduction, the all-or-none law and the doctrine of "specific nerve energies." He then takes up the senses in order, giving of necessity most space to vision with its numerous subtopics, including especially color vision and the perception of space and form. The part on hearing makes a neater and better integrated story and is perhaps the most excellent portion of the book. The story of taste and smell is quickly told, but there is much to say on the cutaneous and internal senses, with a chapter also on the perception of time and movement.

There are of course many special topics, such as color blindness, perception of the third dimension, localization of sounds, the upper and lower limits of audible vibrations, the muscle sense, the sensitivity of the viscera and each such topic has its special history. In general theory, psychology is said to have been concerned in the nineteenth century with an attempt to describe conscious experience by analysis into elementary sensations and discovery of their modes of composition, while in the twentieth century it has moved away from such elementarism either toward the behavioristic and positivistic concern with discriminatory reactions and the conditions that make discrimination possible or toward Gestalt psychology with its emphasis on the total field and the dynamics of field forces. Gestalt psychology is conceived rather broadly by the author and so made to include the work of some psychologists who are not exactly adherents of the "Gestalt school." In reading the detailed story of the various problems that have been subjected to experiment, one does not find it easy to see how the shift in theory has had much to do with the course of investigation. One rather gets the impression that those very general theories have been a recreation or hobby of the psychologists and that in their work as experimenters they have been guided by much more specific questions. It may well be true, as the author says, that the old theories have sometimes cramped the investigators and acted as inhibitors of free experi-

mentation. The egoism of old schools who will not admit their sins of omission and commission and the egoism of new schools who dislike to allow any merit to their predecessors are handicaps to progress that may well be removed by thoughtful attention to a broad-minded history such as this one of Boring's.

R. S. WOODWORTH

COLUMBIA UNIVERSITY

# SOCIETIES AND MEETINGS

## THE ALABAMA ACADEMY OF SCIENCE

THE nineteenth annual meeting of the Alabama Academy of Science was held at Howard College, Birmingham, on March 20 and 21, President-elect W. M. Mobley presiding. Over one hundred and fifty members and visitors were in attendance. The business and executive meetings were held on Friday. Friday afternoon and Saturday morning were devoted to sectional meetings. Seventy-seven papers were presented.

The following chairmen presided at the section meetings: Biology and Medical Science, Alvin V. Beatty, University; Chemistry, Harold E. Wilcox, Howard College, Birmingham; Geology and Anthropology, E. F. Richards, University; Geography, Conservation and Allied Subjects, Brooks Toler, Division of Forestry, Montgomery; Physics and Mathematics, W. A. Moore, Birmingham-Southern College, Birmingham; Industry and Economics, John Goff, Alabama Polytechnic Institute, Auburn; the Teaching of Science, Miss Clustie E. McTyeire, Hueytown High School, Bessemer.

On Friday members of the academy and visitors were served a delicious complimentary luncheon in Renfro Hall by McKesson-Doster-Northington. The annual banquet was held at the Tutwiler Hotel on Friday evening, with Dean P. P. Burns, of Howard College, as toastmaster. Colonel Theodore Swan, president of the Swan Chemical Company, gave an interesting address on the subject, "Chemistry in Industry." On Saturday morning a geological field trip was conducted by Dr. R. S. Poor, of Birmingham-Southern College, through the Walker Gap section of Red Mountain.

At the annual business meeting it was voted to award the grant-in-aid for 1942 from the American Association for the Advancement of Science to Dr. John Xan, of Howard College, to carry on his work on "The Study of the Reaction of Mercaptans with Oxygen in NAOH (Sodium Hydroxide)."

The academy accepted the invitation of Alabama Polytechnic Institute, Auburn, for the place of meeting for 1943.

The following officers were elected for 1942–43: *President,* W. M. Mobley, Alabama By-Products Corporation, Tarrant; *President-elect,* E. V. Jones, Birmingham-Southern College, Birmingham; *Councilor of the American Association for the Advancement of Science,* Septima C. Smith, University, reelected; *Editor of the Journal,* E. B. Carmichael, University; *Counselors to the Junior Academy,* H. E. Wilcox, Howard College (two years); Miss Swan Ella Owens, Opp High School, Opp (three years). The term of office of the treasurer, John Xan, Howard College, continues for two more years, and that of the secretary, Winnie McGlamery, Alabama Geological Survey, University, one more year. R. M. Harper, Alabama Geological Survey, University, continues in office as academy statistician.

The Junior Academy met at the same time as the Senior Academy at the Woodlawn High School, where they had their exhibits and papers under the direction of P. P. B. Brooks, chairman of counselors to the Junior Academy.

WINNIE MCGLAMERY,
*Secretary*

# REPORTS

## THE NEW YORK BOTANICAL GARDEN[1]

As this report is being written, the fourth I have had the privilege of submitting, the United States has become involved in war. War on the scale required by the present struggle will influence the New York Botanical Garden in various ways, and it seems desirable at this time not only to review the past year, but to report briefly on the entire period during which I have served as director of this institution.

No organization remains quiescent, its material facilities, its staff, its activities, its spirit and morale change from year to year. Some changes are for the better, some are for the worse, and any group responsible for the conduct and management of a public institution can feel satisfied if the net of the changes over a period of years indicates progress toward a greater usefulness and a closer approximation of the objectives for which the institution was established. This I believe has been accomplished at the New York Botanical Garden, as demonstrated by the record for the years 1937–1942.

No period since the establishment of the garden, the construction of the museum and administration building and of the main display greenhouse, has witnessed

[1] From the annual report of the director, Dr. William J. Robbins, for 1941.

such a marked improvement in our material facilities as the past four years. A review of the major items is instructive. They include the completion of the rebuilding of the main display conservatory; the fencing of the garden; extensive rearrangement and construction in the museum and administration building, including new wash-rooms, a members' room and the bricking up of the end walls; the construction of a new root cellar and coldframes, the extension of the Boulder Bridge; the construction of a new roadway and numerous paths, the rehabilitation of the Lorillard stables as a service building, the installation of a heating plant in the propagating houses; reconstruction of the interior of House No. 1 in Range 1; the building of a walled experimental garden and of a series of cold pits, and the resurfacing of the paths around Range 2. Some of these items were included in the agreement with the city made on the exchange of land. For all of them the garden is indebted, through the cooperation of the Park Department of the City of New York, to the City of New York and to the Works Progress Administration or its successor, the Work Projects Administration.

Not only have marked improvements been made in our buildings, roads and fences, but notable horticultural accomplishments for this period should be recorded. Exhibits were resumed at the International Flower Show, resulting in striking displays of begonias in 1939, of ferns in 1940 and of the plants of the Bible in 1941. We took part in the New York World's Fair. We have replanted and rearranged in attractive naturalistic form much of the display material in the main conservatories. We reinstituted the annual flower shows in the conservatories from November to May. We have more than doubled the number of our accessioned species and varieties of hardy trees and shrubs, and have increased the species and varieties of plants in cultivation at The New York Botanical Garden to more than 12,000. We have initiated and developed a program of education in gardening which now includes more than 500 adults annually.

Public interest in the garden is a difficult thing to measure. We have no means of recording our attendance, which might be used as one standard of public interest. We have not kept a statistical record of the inquiries from individuals, groups and business firms, which could be expressed in figures. From other sources, however, on which figures can be cited, it would appear that public interest has increased, and that the garden is performing more and better service than ever before. For example, subscriptions to the *Journal* were 75 in 1938, and 665 in 1941. This is in addition to the distribution made to members as part of their membership fee. Attendance at the Saturday afternoon lectures was 3,040 in 1937, and 7,000 in 1941, and attendance in the gardening courses increased fourfold between 1938 and 1941.

During this period in which the material facilities and the activities of the garden were increasing, it is particularly gratifying to report that our capital funds were so managed that they suffered no decrease. This is a noteworthy accomplishment on the part of our finance committee. Few institutions which depend in whole or in part on endowment can point, as the New York Botanical Garden can, to an endowment unimpaired from the original receipt of the gifts and bequests, and to a budget which is balanced annually and shows no deficit.

One of the outstanding events during the period under review was the completion of arrangements for a new base plan for the future development of the garden. Changes in the limits of the garden and its fencing in 1940 made necessary a reconsideration of traffic and landscaping. Major Gilmore Clarke has been retained by the board of managers to prepare such a plan and considerable progress has already been made. The preparation of this plan was made possible by the generosity of Mrs. Harold I. Pratt.

On the debit side must be recorded the loss of the services of a number of members of the staff: by retirement Mr. Robert S. Williams, Mr. Percy Wilson and Dr. J. H. Barnhart, and by resignation Dr. A. C. Smith. With the exception of Dr. Barnhart, none of these men has been replaced with new appointments. Furthermore, the garden has lost many of its most loyal friends by death.

# SPECIAL ARTICLES

## SULFHEMOGLOBIN FORMATION AND LABILE IRON IN VITRO AND IN VIVO

THE indispensability of oxygen in the formation of sulfhemoglobin from hemoglobin in the presence of sulfide ion has been explained[1] by postulating hydrogen peroxide from the autoxidation of hydrogen sulfide[2, 3] as the reactant. Other authors have concluded independently, either on the same basis[4] or from different premises,[5] that hydrogen peroxide has a significant function in sulfhemoglobin formation.

[1] G. Barkan and O. Schales, *Z. physiol. Chem.*, 253: 83–104, 1938.

[2] O. Schales, *Ber. chem.*, 71: 447–460, 1938.

[3] C. Henze, *Klin. Woch.*, 17: 24, 1938.

[4] R. Lemberg, *The Australian Chemistry Institute Journal and Proceedings*, 6: 170–180, 1939.

[5] H. O. Michel, *Jour. Biol. Chem.*, 126: 323–348, 1938.

On the basis of its manner of formation, its green color and its absorption spectrum, sulfhemoglobin was considered by Barkan and Schales[1] as possibly belonging in the class of open-ring derivatives of hemoglobin. Lemberg[4] considered it ". . . probable that the porphyrin ring of sulphaemoglobin is opened, but in such a way that by the action of alkali it is closed again; . . ." Jung[6] and Heubner[7] recently classified sulfhemoglobin as belonging to the group of iron-containing bile pigment compounds for which they use the general term "verdohemochromogen," a name previously introduced by Lemberg[8] for a well-defined open-ring heme derivative. Since in such open-ring derivatives the iron is "easily split off" or labile by the action of dilute acid,[9] an increase in the labile iron might be expected to accompany the conversion of hemoglobin to sulfhemoglobin; such an increase has been observed in experiments *in vitro*.[10] In those experiments the hemoglobin solutions had been treated with $H_2S$ and oxygen for several hours, the minimum period being two hours. Secondary alterations and side reactions may have occurred during such length of time, giving rise to the formation of labile iron quite independent of sulfhemoglobin itself.

Formation of sulfhemoglobin and an increase in the labile iron can now be demonstrated after much shorter periods of treatment. Table I shows typical results as obtained with blood of different sources. It can be seen that admission of $H_2S$ for only a few minutes results in a definite increase in the labile iron fraction.

TABLE I

EFFECT OF SHORT TREATMENT WITH $H_2S$ UPON SULFHEMOGLOBIN FORMATION* AND LABILE IRON

| No. | Source of blood | Duration of $H_2S$-flow | Labile iron† | |
|---|---|---|---|---|
| | | | Before | After |
| | | minutes | mg per 100 ml of blood | |
| 1 | man | 1 | 1.28 | 2.19 |
| 2 | man | 2 | 1.05 | 4.26 |
| 3 | calf | 3 | 1.68 | 5.32 |
| 4 | rabbit | 5 | 1.12 | 4.46 |
| 5 | rabbit | 5 | 1.54 | 3.43 |

* Sulfhemoglobin was spectroscopically identified in all experiments after $H_2S$-treatment.

† For the iron determinations in this paper either Barkan's (*Klin. Woch.*, 16: 300, 1937) or Barkan and Walker's (*Jour. Biol. Chem.*, 135: 37, 1940) method was used; care was taken that the preliminary digestion with diluted hydrochloric acid took place under identical conditions in the normal and in the sulfhemoglobin containing blood solutions.

An inhibitory action of carbon monoxide on the lability of the additional iron had been missed in the previous experiments of much longer duration,[10] although the characteristic spectroscopic change occurred, described long ago by Clarke and Hurtley.[11] In the short-time experiments, such an inhibition could occasionally be found.

In a series of experiments with human blood, the amount of sulfhemoglobin formed by a few minutes' treatment with hydrogen sulfide (in presence of oxygen) *in vitro* was compared with the increase in labile iron (see Table II). Only a third or less of the iron calculated from sulfhemoglobin present was found to be labile. It was assumed for the purpose of calculation that the iron content of sulfhemoglobin is the same as that of hemoglobin. This assumption agrees with Haurowitz's[12] analytical figures.

TABLE II

RELATION OF INCREASE IN LABILE IRON TO SULFHEMOGLOBIN CONTENT ON SHORT TREATMENT WITH $H_2S$ OF HUMAN BLOOD *in vitro*

| No. | SHb* | Increase in labile iron | | Found/ calculated |
|---|---|---|---|---|
| | | Calculated from SHb | Found | |
| | grams per 100 ml of blood | mg per 100 ml of blood | | per cent. |
| 1 | 1.34 | 4.56 | 0.9 | 19.7 |
| 2 | 4.75 | 16.15 | 3.37 | 20.9 |
| 3 | 4.27 | 14.52 | 3.21 | 22.1 |
| 4 | 4.66 | 15.85 | 3.64 | 23.0 |
| 5 | 0.26 | 0.88 | 0.29 | 32.8 |
| 6 | 0.68 | 2.31 | 0.34 | 14.7 |
| 7 | 3.33 | 11.32 | 2.82 | 24.9 |
| 8 | 0.64 | 2.18 | 0.42 | 19.3 |
| | | | Average: | 22.2 |

* Quantitative sulfhemoglobin determinations were made photoelectrometrically according to K. A. Evelyn and H. T. Malloy (*Jour. Biol. Chem.*, 126: 655, 1938).

*Sulfhemoglobinemia in rabbits* was induced, following the procedure of Hijmans van den Bergh and Engelkes,[13] by the daily administration of two grams of precipitated sulfur dispersed in water with gum arabic, using a stomach tube. The dose was repeated three to seven times. After a total administration of six or eight grams of sulfur, sulfhemoglobin was spectroscopically demonstrable in the blood, increasing with continuation of the feeding of sulfur (quantitative SHb determination as in Table II, footnote). The labile iron was determined both before the sulfur administration had been started and after sulfhemoglobinemia was established. In four rabbits studied, demonstrable enterogenous sulfhemoglobinemia was not accompanied by an increase in the labile iron. This fact sets it off sharply as an entity quite different from the "sulfhemoglobinemia" produced by exposure of blood *in vitro* to hydrogen sulfide and oxygen. The amount of sulfhemoglobin usually found in such experiments was in the neighborhood of 0.3 grams per ml of blood. Assuming an iron content of sulfhemoglobin of 0.34 per cent., the 0.3 grams of sulfhemo-

[6] F. Jung, *Arch. exp. Path. und Pharmakol.*, 194: 16–30, 1939.

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[10] G. Barkan and O. Schales, *Z. physiol. Chem.*, 254: 241–249, 1938.

[11] T. W. Clarke and W. H. Hurtley, *Jour. Physiol.*, 36: 62–67, 1907.

[12] F. Haurowitz, *Z. physiol. Chem.*, 151: 130–144, 1926.

[13] A. A. Hijmans van den Bergh and H. Engelkes, *Klin. Woch.*, 1: 1930–1933, 1922.

globin would correspond to about one milligram of iron. This amount of iron and even a fraction of it would be easily measurable by the method used, if it were in a labile, open-ring compound.

### DISCUSSION

In 1939 Lemberg and his associates[14] confirmed "that the iron of sulphemoglobin can be easily detached," but they pointed out that sulfhemoglobin ". . . cannot be a bile pigment-haematin compound." From the present study it becomes perfectly clear that the iron in sulfhemoglobin as it occurs *in vivo,* at least during enterogeneous sulfhemoglobinemia in rabbits, can not be a part of an open-ring compound, since there is no increase whatsoever in labile iron coincident with the occurrence of sulfhemoglobin in the blood.

It is equally clear that the preparation of sulfhemoglobin *in vitro,* even in experiments of very short $H_2S$-treatment, is accompanied by an increase of the labile iron, in 8 experiments with human blood averaging about 22 per cent. of the calculated sulfhemoglobin iron.

The question which remains undecided is whether in short-time experiments the substance or substances with labile iron are independent compounds or rather intermediates in the formation of sulfhemoglobin. These may be formed by the well-known action upon heme of nascent hydrogen peroxide originating from oxidation of $H_2S$.[2, 3] The conversion of the presumptive precursor with labile iron into sulfhemoglobin with firm iron may well be by the entry of sulfur into the molecule.[5, 14, 15] The findings of the present study, together with the data in the literature[5, 12, 14, 15] make it most probable that sulfhemoglobin in its final stable form, as best exemplified when it is produced *in vivo,* is a substance with closed ring. If the ring be opened in a first step reaction, it seems highly reasonable that the reclosure is accomplished by a sulfur-containing group; no direct proof of this last suggestion is available so far.[16]

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[14] R. Lemberg, J. W. Legge and W. H. Lockwood, *Biochem. Jour.,* 33: 754–758, 1939.

[15] F. Haurowitz, *Jour. Biol. Chem.,* 137: 771–781, 1941.

[16] This work, assisted by a grant from the *Fonds d'Etudes "Roche,"* was begun in the Institut de Physiologie de l'Université de Lausanne, Switzerland. One of the authors (G.B.) wishes to express his gratitude to Professor A. Fleisch, head of the named institute, for his friendly hospitality and helpful cooperation during the summer of 1938.

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## SKIN SENSITIVITY TO HUMAN PLASMA

A RECENT report of a reaction to the transfusion of human plasma[1] contradicts the published opinion[2] that the intravenous administration of plasma is entirely innocuous. Our own experience with group-specific plasma indicates that reactions do occur. We have employed a number of experimental methods to ascertain the cause of these reactions. One of these, skin testing with plasma, has yielded some new and interesting information.

The plasma used in these experiments was syphoned off freshly drawn blood. The erythrocytes were allowed to settle by sedimentation for from 24 to 72 hours at 4–8° C. before the plasma was removed. The tests were made by injecting 0.05 cc of undiluted plasma intradermally on the volar surface of the forearm. The sites of injection were observed after 10, 30 and 60 minutes.

Positive reactions were indicated by the formation of a wheal 0.8–3 cm in diameter, plus a surrounding zone of erythema. Erythema alone was found to be of no significance. The wheal usually appeared in 10 minutes, reached a maximum in 30 minutes and began to fade at the end of one hour. Citrate and sulfanilamide as used in the preservative and anticoagulant solution yielded uniformly negative skin tests. Of 109 patients tested with the plasma from all blood groups, 20 per cent. were positive to one or more plasmas. Sensitivity to the various plasmas was not confined to individuals of any particular blood group. The positive reactions were not associated with any specific plasma, since the same specimen gave negative and positive results in different individuals. We were able to transfer passively the plasma sensitivity to non-sensitive individuals.

It was possible to transfuse nine of the sensitive patients. Seven of these gave a reaction to the intravenous administration of the same plasma giving a positive skin test. Reactions encountered in the sensitive individuals included headache, dyspnea, epigastric distress, chills, fever and urticaria. No fatal reactions occurred. Plasmas giving negative skin tests have not produced any transfusion reactions.

There are three likely causes for the positive skin tests: allergins, iso-antibodies or A and B substance in the plasma. Schiff[3] has demonstrated the presence of the A factor in serum. We have confirmed the work of Aubert and his coworkers[4] in establishing the presence of A and B substance in plasma. Of the three causes of positive skin tests, it is our belief that

[1] *Jour. Am. Med. Asn.,* 118: 1050, 1942.
[2] *Ann. of Surgery,* 111: 623, 1940.
[3] *Klin. Wschr.,* 3: 679, 1924.
[4] *Jour. Path. and Bact.,* 54: 89, 1942.

the A and B factors are most important in accounting for the dermal reactions. This belief is based on the fact that individuals who show skin sensitivity to A or B plasma are also sensitive to AB plasma. Also individuals sensitive to A or B plasma are sensitive to Witebsky's purified A and B substance.[5]

The correlation between the skin tests and the transfusion reactions is suggestive, but further work is necessary before any conclusion can be reached as to the cause of the reactions. It is not known what pooling of plasmas will do toward the elimination of transfusion reactions. Pooling of plasmas from bloods of incompatible groups failed to neutralize the skin reacting substance. For example, an individual of group O, sensitive to A plasma, still gave a positive skin test after the A plasma had been mixed with an equal volume of B plasma.

From our results it is obvious that plasma reactions do occur, and that there is a correlation between skin sensitivity to the plasma and reactions after plasma transfusions. Negative skin tests preclude the possibility of reactions to intravenous administration of the plasma. Therefore, to prevent reactions, skin tests should be used wherever possible prior to a transfusion.

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# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## ELIMINATION OF CONTAMINANTS WITH ULTRA-VIOLET RADIATION

SMITH[1] has described an air filtration apparatus with which it is possible to reduce considerably the population of spores of fungi and of bacteria present in the laboratory atmosphere. The purpose of reducing the atmospheric spore load is to enable the preparation and transfer of cultures without losses from contamination. A means of establishing atmospheric sterility is particularly desirable when the conditions are such that an excessive amount of contamination still occurs after every precautionary measure has been employed.

An inexpensive, ultra-violet generator[2] has been devised which is intended for use under laboratory and industrial conditions where the strictest sanitation is desired. A brief study on the practical effectiveness of the generator in reducing air-borne contaminants has indicated that it is superior to the air filtration apparatus described by Smith.

The tests were carried out in a small room in which two 30″ ultra-violet generators are mounted on the ceiling equidistant from the ends of the room. The room is used almost daily as an inoculation chamber for the manufacture of grain spawn. Grain spawn is made by inoculating a sterile rye grain medium in a milk bottle with the mycelium of the cultivated mushroom, *Agaricus campestris*. Mold spores or bacteria which invade the bottle at the time of inoculation grow luxuriantly on the rye grain medium and render the bottle worthless as spawn. In commercial practice a large number of bottles are inoculated at one time. The number of bottles which become contaminated is dependent on the density of the spore population in the atmosphere of the chamber. The air filtration apparatus mentioned above is also mounted for permanent use in the chamber so that an opportunity has been afforded to directly compare the effectiveness of air filtration with ultra-violet radiation in reducing contamination.

In a preliminary test the chamber was contaminated as much as possible by blowing in air from an adjoining unclean room. The door was then closed and ten sterile petri dishes containing potato-dextrose agar were placed on small tables in various parts of the room. These were then exposed to the atmosphere for three minutes each. During the exposure the air in the chamber was kept in constant motion by turning on the air filtration apparatus after closing the air outlet vent. The chamber was again contaminated and the ultra-violet generators turned on. At the end of each hour, for the next five hours, ten petri dishes were exposed in the same manner as the first ten. All the dishes were then incubated for five days. The number of contaminants in each dish was recorded. No distinction was made between a bacterial and a fungus colony. The results are shown in Table 1.

For all practical purposes the atmosphere of the chamber was rendered sterile after 4 hours of radiation.

In another preliminary test 3 common molds which frequently contaminated the bottles were isolated and their lethal dosages determined. A spore suspension was made of an unidentified Penicillium species, an unidentified Alternaria and *Monilia sitophila*. The suspensions were then sprayed over the surface of glass slides covered with a film of agar. The slides were then exposed to the radiation at a distance of 5′ from the source. All the Penicillium spores were

[5] Supplied by Eli Lilly and Company.

[1] N. R. Smith, SCIENCE, 75: 199–200, 1932.

[2] Westinghouse Sterilamp. The radiation is produced by a discharge through a mixture of inert gases in a tube containing mercury vapor at low pressure.

TABLE 1

STERILIZATION OF THE ATMOSPHERE WITH ULTRA-VIOLET RADIATION

| Hours of radiation | Average number of contaminants in 10 dishes exposed for 3 minutes |
|---|---|
| None | 15.1 |
| 1 | 11.6 |
| 2 | 9.7 |
| 3 | 1.3 |
| 4 | .1 |
| 5 | .1 |

killed in two hours at this distance. The Alternaria and Monilia spores were killed after 1.5 hours of radiation. In order to secure consistent results it is necessary to agitate the suspensions violently before spraying, since the spores frequently tend to stick together in clumps and screen each other from the radiation.

The lethal dosages of three common spore-forming bacteria were determined in the same manner. *Bacillus subtilis* and *B. mycoides* were killed in 25 minutes. *B. mesentericus* was killed after 45 minutes of radiation.

The effectiveness of the ultra-violet generators was practically illustrated by using them in the commercial manufacture of grain spawn. In the spawn plant where the tests were carried out,[3] 180 bottles are sterilized and inoculated at one time. The sterilizer is inside the chamber. The records showed that the average loss from contamination over a period of time was about 11 per cent. or 20 bottles per set when no attempt was made to sterilize the chamber. The average loss was cut down to about 6 per cent. or 11 bottles per set when the air filtration apparatus was used. In this method, filtered air was admitted into the chamber for a period of two hours before the inoculation and was allowed to remain on during the inoculation. The loss was cut down to about 1 bottle per set with a modification of the air filtration technique. The modification consisted of fumigating the room with formaldehyde and then blowing out the fumes with filtered air. It was not considered possible to reduce the loss below this figure under commercial conditions. When the ultra-violet generators were used, the chamber was radiated for four hours previous to the inoculation. The average loss in ten sets was about 1 bottle per set.

The radiation method of reducing contamination is more desirable since it is simpler and less drastic than the formaldehyde-air filtration technique.

In laboratories, and especially in industrial operations, where contamination is a constant problem the installment of a chamber equipped with ultra-violet generators would be a practical solution. It is advisable, although probably not necessary, to have the autoclave right in the chamber to avoid carrying sterile material through a contaminated atmosphere.

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## SOLUBILITY OF ANTERIOR PITUITARY GONADOTROPIN IN ALKALI HALIDE SOLUTIONS[1]

IN a study of the extraction and purification of the gonadotropic factor of the anterior lobe of the pituitary gland, it was found that aqueous solutions of the alkali halides are good solvents for this hormone.

Acetone-dried sow pituitary powder was extracted with 20 and 10 parts of the salt solutions. The powder was shaken with the salt solution in a mechanical shaker four hours, then centrifuged at 3,500 rpm for twenty minutes at room temperature. Aliquot portions of the supernatant fluid were then dialyzed against distilled water for 14 hours in a refrigerator.

Values given in Table I (calculated back to the original extract) show the R. O. U. (rabbit ovulation unit) per cc of solvent as compared with distilled water extract.

TABLE 1

| Solvent | Rabbit Ovulation Unit/cc | |
|---|---|---|
| | 10 : 1 solution | 20 : 1 solution |
| Distilled water | 70 | 40 |
| 25 per cent. satn. NaCl | 80 | .. |
| 50 " " " " | 90 | 45 |
| 64 " " " " | 70 | .. |
| 10 " " " LiCl | 65 | .. |
| 25 " " " " | 180 | 95 |
| 50 " " " " | < 40 | .. |
| 50 " " " KCl | 60 | .. |
| 50 " " " $NH_4Cl$ | 170 | > 100 |

Studies in progress using acetone-dried sheep and horse pituitary powder indicate comparable results.

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[1] From the Department of Obstetrics and Gynecology, University of Rochester Medical School and Strong Memorial Hospital.

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